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To be or to be not, that is the dilemma.

The basic function of the human mind is to concentrate its attention on a part of the whole. It is like this because, on the one hand, the human being can only be conscious of what he perceives with his senses and, on the other hand, the human brain has dimensions that allow it to consider a limited number of entities. As of that moment, those entities or *elements* constitute his *universe.*

Take the following universe, defined by the *enumeration* of its elements.

$$\mathscr{U} = \{2, \triangle, 6, 1, \curlyvee, \square, 4, \times, 3, 12, \mathit{three}\}$$

In enumerations, the order is not important but the total number of elements is: it is called the *cardinal number of the universe.* In this case, $\#\mathscr{U} = 11$.

After fixing his attention on certain elements, the human mind finds similarities between them, causing it to group some together and divide the universe into parts. The outcome of the action of grouping elements is called a *set.*

$$A = \{1, 2, 3, 4, 6, 12\}$$

A is the set of natural divisors of 12 (expressed formally).

Different people may use different characteristics to find similarities between these elements as might the same person under different circumstances. For example, other characteristics of the elements of $\mathscr{U}$ can lead to form the following set.

$$B = \{\triangle, \curlyvee, 3, \mathit{three}\}$$

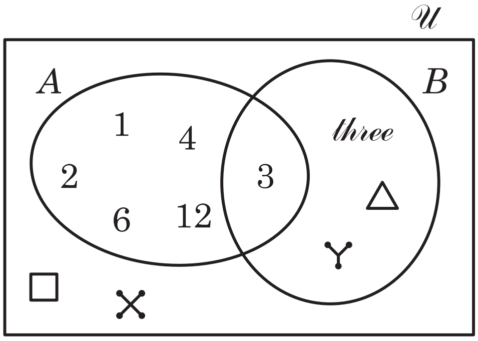
B is the set of elements that could represent the number 3.

When the elements in a set are selected for a common characteristic it is said that a *selection criterion* has been applied. Such criterion can be used to define the set without the need to enumerate its elements, which is practical, especially when dealing with numerous elements. If the elements were grouped without applying any criterion, the only possible way to define it is by enumeration. However, the criterion is not always something easy to discover. Take the following set.

$$C = \{3, 6, 12\}$$

At first glance, these numbers are not the result of applying a criterion. However, they arise from multiplying the remaining elements in A (1, 2 and 4) by 3. The usefulness of a criterion often depends upon the subject being studied: the A set may be of interest when studying the divisibility of numbers; B, when studying numeration systems; C, when studying recursive definitions.

The relationship that links an element to a set is called *membership.* For a given universe and a given criterion this relationship is *binary,* that is, an element either does or does not belong to a set. Thus, the elements in $\mathscr{U}$ could, or could not, belong to set A, the natural divisors of 12. A set is precisely defined, leaving no room for ambiguous terms. Because of that, universe and sets are represented in diagrams like the following one.



In these diagrams, know as *Venn diagrams,* (in honor of the British mathematician and logician, John Venn, 1824–1923), elements may not be located over the delimiting lines of the sets.

An element's membership in a set may be formally expressed as: $6 \in A$. It should be said that the notation: $\mathit{three} \notin A$, has also been used to show that an element does not belong to a set. However, the two expressions are not comparable: to say that an element belongs to a set is to give affirmative information; saying that it does not belong is to leave open the possibility that it could belong to any other. But, since all of the elements belong to the universe $\mathscr{U}$, this difficulty could be avoided by writing: $\mathit{three} \in {\sim}A$. This last one being the set of elements that do not belong to A:

$${\sim}A = \{\triangle, \curlyvee, \square, \times, \mathit{three}\},$$

or better yet, the set that is formed when the elements from A are removed from $\mathscr{U}$, which is called the *complement* of A.

(continued on page 2)

MAIN ARTICLE

Ontology and Dialectics

The subject of being as being, in its different levels of abstraction (an entity, certain entities, the entities, the entity), is the subject of ontology, the "first philosophy." An entity is something when it belongs to the universe and a selection criterion has been applied. Multiple criteria within the same universe lead to confront concepts. This is the subject of the "second philosophy," dialectics. Together with logic, these form the nucleus of Western philosophy.

(page 2)

HISTORICAL NOTE

The Eleatic School

In a Greek colony in what is now the region of Campania (Italy), Parmenides began a way of thinking based on the entity (that which is), opposed to that of the writers of myths, who used a language of multiple meanings, the poetic language. Parmenides' ideas are in direct connection to the basic premises of the set theory.

(page 3)

BACK PAGE

INTERVIEW WITH JOTAJOTA

Why publish?

In a typical researcher's office, filled with books, papers and computers, Juan José Luetich speaks to us about his writing techniques and the reasons for making his work known to others.

BIOGRAPHICAL SKETCH

Juan José Luetich

A multifaceted public figure, the creator of cultural trends, his natural propensity for thinking and writing, together with his work as an educator have turned him into a worshiper of clarity.

PRINTING NOTES

About this publication

Transactions is a serial publication of The Luventicus Academy, an NGO promoting information, education, science and culture. This supplement is dedicated to rescuing the works of Juan José Luetich, which were almost lost in late 2010.

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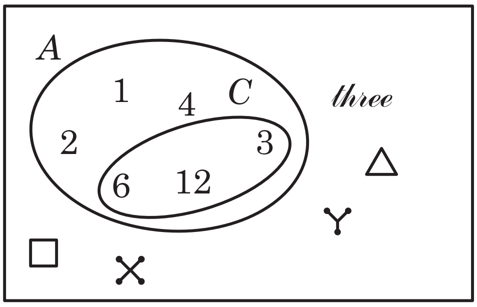
Ontology and Dialectics

THE FRONT PAGE ARTICLE used a universe $\mathscr{U}$ and three sets, *A, B* and *C,* as examples, of which only two were represented in the Venn diagram. The following diagram shows the sets *A* and *C*.

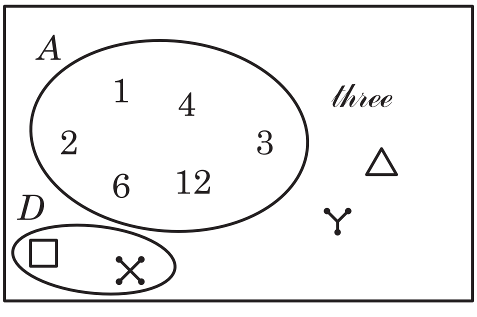


These illustrate the *inclusion relationship,* which links one set to another. Since all of the elements in *C* are also in *A,* it is said that *C is included* in *A* or that *C* is a *subset* of *A*. Formally, $C \subset A$.

In general, for any two sets it could be: that they have common as well as individual elements (the case with *A* and *B*), that only one has individual elements and the rest of them are common (the case with *A* and *C*), or that they do not have common elements. This last one would be the case with *A* and *D,* where *D* is the set of non formal representations of the number 4:

$$D = \{□, ✕\}.$$

Such a situation is illustrated in the following diagram.



The sets of this type are called *disjoint* sets and the criteria used to define them are called *exclusive.* Disjoint sets can also be of two kinds: *non-complementary disjoint sets* (the case with *A* and *D*) and *complementary disjoint sets* (the case with *A* and *~A*). In this last case, gathering together the elements of both sets, creates a set with all the elements of the universe.

The set that gathers together the elements of two sets to form a new set is called *union* and the operation is denoted as ∪. Thus, for example, $A \cup B = \{2, △, 6, 1, Y, 4, 3, 12, \textit{three}\}$. The set created from the elements that two other sets have in common is called *intersection* and the operation is denoted as ∩. Thus, for example, $A \cap B = \{3\}$. If there are no elements in common (the case with disjoint sets), it is said that the intersection is *empty:* $A \cap D = \{\}$.

So, based on the above, for complementary disjoint sets we have that:

$$A \cap {\sim}A = \{\};\ A \cup {\sim}A = \mathscr{U}.$$

The last of the two conditions will not be true in the case of non-complementary sets. The union of complementary disjoint sets bears a unique result, $\mathscr{U}$; the union of non-complementary disjoint sets could bear many results. And this forces us to express it as: $A \cup D \neq \mathscr{U}$, of which we could say the same thing (nothing good) as what we said about the non-membership relationship. The notation ≠ is the same thing as saying "it is not equal to" and, therefore, it represents a denial.

Ontology deals with exclusive complementary definitions. An ontological problem would be to ask oneself: What is a natural divisor of 12? On to a different matter, ontology could ask: What are sports? What is education? What is science? But most of the times, these questions, and many others, involve concepts that don't have complements which can be given a usual name. For example: What is the complementary concept for "sports?" And the one for "education?" And the one for "science?" In these cases it is often useful to use another concept to contrast it with. Thus, "sports" could be opposed to "game," "education" to "instruction," "science" to "religion." That art, the art of testing definitions whose subject is the entity not as entity but rather in relation to other entities, is called *dialectics,* and it can also be called the *second philosophy* (see the Historical Note). Ontology, dialectics and—as will be seen later—logic, form the basis for the Western philosophical thought.

Ontology deals with defining entities or with discovering the criterion used to define an entity; then, dialectics confronts definitions in the same universe. In the case of the "sports versus game" opposition, that which is understood by sports, and that which is understood by game must be clearly defined at first. For example, to discover what the underlying criterion for the sports set is, an *ontological table:* sports versus not sports, could be drawn first. The elements on both columns are the universe being considered. The column headings are

(continued on page 3)

FRONT PAGE

To be or to be not

(continued from page 1)

The preceding paragraph is filled with subtlety and I invite the reader to read it again. Membership and non-membership have different entities. A membership relationship is an affirmation, while a non-membership relationship is a denial that opens up multiple possibilities. If an element belongs to *A,* there are no doubts: it is a divisor of 12. If it does not belong to *A,* it could be a word, a figure, a doodle… But the solution is found in the problem itself: if an element does not belong to *A,* it is a *not divisor of 12.* An element is a divisor of 12 or it is a not divisor of 12.

Whoever establishes the criterion that defines a set faces a dilemma: If the element does not fall within the set, it remains within its complement. But this fact should not torment him—as the existential question did the Prince of Denmark in Shakespeare's tragedy—because that is precisely the strength of the set membership, i.e. the strength of being.

How to collaborate

We worked very hard during 2011 to organize the notes of Juan José Luetich. The task was not easy, but today we are satisfied to have found the logical dependence of countless works that are difficult to classify either by extension or by subject matter. Just to mention a few examples, Juan José Luetich's files includes: a series of articles regarding the basics of phenomenological thermodynamics, a historical reconstruction of the cult of Osiris, notes regarding metascientific visions in scientific experiments, a review of several topics on the theory of numbers, a theory for a new musical system, the description of an ideal machine *(Gedankenexperiment),* notes on matters regarding Indo-European linguistics, a technique for teaching the design and sizing of chemical reactors, a contents management system written in LISP, literary criticism articles, moral and political writings, textbooks, a translation of *"Entity and Essence"* by Thomas Aquinas with must-read notes, a book of piano études, and articles on the works of Boscovich, Legendre, Boltzmann, J. W. Gibbs, Langmuir and G. N. Lewis. After considering various options, we chose the newsletter format to publish the works. If you believe, as we do, that the dissemination of these works is a worthy goal, you can collaborate by subscribing to the printed version. The (not identical) online version is free. You may also collaborate by sending comments or questions or by talking to others you know about the characteristics of these works. For further details, visit the website for this supplement of Transactions.